The U.S. Environmental Protection Agency and the Food & Drug Administration Worked Together to Protect the Health of the American Food Supply by Developing an Analytical Method to Quantitate Part-Per-Billion Levels of Carbamate Pesticides in Eggs

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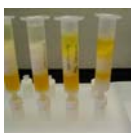
Eggs are an American dietary staple. Each person in the U.S. eats about 250 eggs a year.

Carbamates are an important class of insecticides used in agriculture. Hens are directly treated with pesticides for external parasites. The carbamate carbaryl is routinely used for treating mites on hens by dusting or dipping.

A healthy diet begins with a safe food supply. To better monitor the American food supply, chemists from the FDA and the EPA developed an analytical method for quantitating carbamate pesticides residues in eggs down to levels as low as 2 parts per billion (ppb).

ANALYTICAL METHOD



1. Eggs are extracted with acetonitrile.

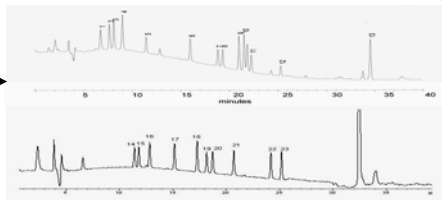
2. The extract is then partitioned and dehydrated with Na_2SO_4 and $MgSO_4$.

3. A portion of the extract is evaporated to 1-2 mL.

4. The concentrated extract is purified using an aminopropyl SPE column. 1%Methanol/methylene chloride is eluted through the column and collected in a tube.

5. MeOH is added to the dried sample, which is filtered and transferred to an auto injector vial for instrumental analysis.

Instrumental Analysis



HPLC fluorescence chromatograms of FDA and EPA egg extracts fortified at 2.0 ppb. Peak identities are the following carbamates: (1) aldicarb sulfoxide, (2) aldicarb sulfone, (3) oxamyl, (4) methomyl, (5) 3-hydroxy carbofuran, (6) aldicarb, (7) propoxur, (8) carbofuran, (9) carbaryl, (10) 1-naphthol, (11) isoprocarb, (12) methiocarb, (13) piperonyl butoxide (14) thiofanox sulfoxide, (15) ethidamuron, (16) thiofanox sulfone, (17) butocarboxim, (18) metolcarb, (19) cloethacarb, (20) bendiocarb, (21) thiofanox, (22) fenobucarb, (23) romecarb.

HOW WELL ARE CARBAMATES AND THEIR METABOLITES RECOVERED FROM FORTIFIED EGGS USING THIS METHOD?

	Recovery (%CV) at 2 ppb	
Pesticide	Laboratory 1	Laboratory 2
1-naphthol	70.0 (7.3)	98.8 (16.7)
3-OH carbofuran	104.2 (9.0)	97.2 (3.3)
Aldicarb	83.7 (5.2)	90.5 (3.0)
Aldicarb sulfone	95.1 (4.5)	97.3 (3.7)
Aldicarb sulfoxide	84.7 (5.2)	84.8 (3.3)
Bendiocarb	79.1(7.7)	93.6 (2.3)
Carbaryl	95.4 (4.8)	99.3 (3.6)
Carbofuran	91.5 (5.4)	96.7 (4.0)
Cloethacarb	94.3 (5.2)	96.8 (3.1)
Isoprocarb	81.6 (5.5)	89.9 (1.2)
Methiocarb	92.8 (12.0)	98.0 (2.6)
Methomyl	92.8 (5.0)	95.8 (2.4)
Metolcarb	75.8 (4.3)	91.2 (0.9)
Oxamyl	90.7 (1.6)	94.5 (3.8)
Propoxur	80.2 (2.9)	107.2 (3.2)
Thiofanox	83.6 (2.0)	94.6 (2.3)
Thiofanox sulfone	95.7 (1.1)	97.2 (3.5)
Thiofanox sulfoxide	99.5 (2.2)	105.1 (13.0)

WHAT ARE THE LEVELS OF CARBAMATES FOUND IN THE EGGS WE MIGHT CONSUME?

To determine this, Single-Comb White Leghorn hens were treated with carbaryl by scientists at the University of Arkansas and the eggs were analyzed by the FDA for incurred residues:

Dosing Method	Days after first dose	Carbaryl (ppb found)	1-Naphthol (ppb found)
Dusting	1	76	69
	2	54	33
	6	42	34
Spraying	2	14	5
	3	15	6
	4	23	6
	5	14	6
	7	19	15
Ingested capsules	1	186	243
	5	365	245
	6	401	232

The levels of carbaryl and 1-naphthol (metabolite) found in the eggs were well below the EPA tolerance level of 500 ppb.

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